A study of the conventional chest physiotherapy versus Flutter® VRP1 in the treatment of patients carrying bronchiesctasis

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ABSTRACT

Bronchiectasis is defined as an abnormal, irreversible dilatation of the bronchi, frequently associated to chronic bacterial infections causing excessive bronchial secretions. Conventional Respiratory Physiotherapy (CRP) (postural drainage with chest clapping) remained the standard for chest physiotherapy for many years until new techniques began to emerge in Europe in the last 10 years. The purpose of this study was to compare the quantity of sputum expectorated, alterations on peripheral oxygen saturation (SpO_2), expiratory peak flow, respiratory and cardiac frequency in 10 patients carrying bronchiectasis treated with CRP or Flutter® VRP1. All patients underwent 4 sessions of CRP and 4 of Flutter® VRP1. No difference was observed when the quantity of sputum expectorated with CRP was compared to that observed with Flutter® VRP1 ($p>0,05$). In conclusion, no clinically significant difference between either technique was observed in patients with bronchiectasis. In addition, no significant modifications of expiratory peak flow, oxygen saturation, respiratory and cardiac frequency was observed with either technique.

Key Words: bronchiectasis, postural drainage, chest clapping, Flutter® VRP1.

INTRODUCTION

Bronchiectasis is defined as a condition characterized by abnormal and permanent dilatation of the airways as a result of the destruction of the elastic and muscular components of the bronchial walls. The affected airway becomes loose, tortuous and partially obstructed (Nicotra, 1994; Barker & Bardana, 1988). These conditions are frequently associated to chronic bacterial infection with production of large volumes of sputum. It is not a specific disease but represents the final stage of different pathological processes (Cohen & Sahn, 1999).

The Conventional Respiratory Physiotherapy (CRP) comprises postural drainage, thoracic manual percussion and vibrocompression (Ciesla, 1988; Imle, 1988; Giles et al., 1995). For a long time it has been accepted as the choice technique to aid in the removal of airways secretions. However, discussions are arising concerning it efficacy in comparison with other procedures introduced in Europe in the last 10 years, being the Flutter® VRP1 one of the most promising (Pryor, 1999).

Since the introduction of CRP in 1915 many authors have demonstrated the benefits of this maneuvers in patients with chronic retention of secretions (Clark et al., 1973; Cochrane et al., 1977; Newton & Bevans, 1978; Bateman et al., 1979). On the other hand, some side effects of this therapeutic practice have been reported. Huseby et al. (1976) have stressed the benefits of the postural drainage but warned to the risk of cardiac arrhythmias that may occur during this procedure. Hammon et al. (1992) have demonstrated that elderly patients with cardiac problems such as angina, myocardial infarction and previous arrhythmias were prone to present such arrhythmias during the physical therapy procedure. The effect on the oxygen saturation (SaO_2) is controversial. McDonnell et al. (1986) reported its reduction in patients with cystic fibrosis while Pryor et al. (1990) did not observe any significant difference in the oxygen saturation during or after CRP.

Flutter® VRP1 is a portable equipment that combines stabilization of airways and favors bronchial clearance, produces positive expiratory pressure and provokes endobronchial vibration during expiration through the equipment, mobilizing mucus. The oscillation in the pressure prevents bronchial collapse facilitating expectoration. This mechanism is similar to the postural drainage associated to pursed lip breathing. However, its use is more comfortable and efficient since the patient himself can use it while the CRP requires time and the participation of a second person (Konstan et al., 1994; App et al., 1998).

Flutter® VRP1 has been recommended for the treatment of patients with bronchial hypersecretion such as chronic obstructive pulmonary disease (Cegla & Retzow, 1993). Konstan et al. (1994) have compared the use of Flutter® VRP1 with induced voluntary coughing in patients with cystic fibrosis and have demonstrated the amount of secretions cleared with Flutter® VRP1 was thrice the amount obtained with other techniques. Girard & Terki (1994) found a significant increase in the forced expiratory volume in the first second (VEF_1), in the vital capacity (VC) and in the peak flow in patients with bronchial asthma after a month of treatment with Flutter® VRP1. It was not found in the literature any reference on the effects of Flutter® VRP1 in patients with bronchiectasis.

Taking into consideration the information above, the aim of this study was to compare the amount of secretion cleared, the alteration in SpO_2 in the expiratory peak flow and in the cardiac (CF) and respiratory (RF) frequencies in patients with bronchiectasis submitted to treatment with CRP and with Flutter® VRP1.

PACIENTS AND METHODS

Pacients

In this study 13 patients with bronchiectasis previously treated in the Rehabilitation wing of the Clinics Hospital of the School of Medicine of Botucatu with domicilary orientation were evaluated. The diagnosis of bronchiectasis was made by clinical history, chest X-ray and confirmed by CT scan. Patients were over 18 years of age and clinically stable, that is, with no history of worsening or hospitalization in the last month. The level of pulmonary function compromise was evaluated by means of values for forced expiratory volume in the first second (FEV_1), forced vital capacity (FVC) and the relation FEV_1 / FVC obtained in the exam available in the medical records.

The study was approved by the Ethical Committee of the Clinics Hospital of the School of Medicine of Botucatu and it was also obtained an Informed Consent from each patient.

Design

Once selected, patients were randomicaly divided in two groups according to the technique: CRP or Flutter® VRP1. Each patient attended twice a week for four consecutive weeks the Rehabilitation wing of the Clinics Hospital of the School of Medicine of Botucatu. Group 1 was treated with the Flutter® VRP1 in the first week alternated with CRP in the second week and so on untill the forth week. Group 2 was initially treated with CRP alternating with Flutter® VRP1 till the last week as can be seen in the resume below. Therefore, all patients underwent four sessions of Flutter® VRP1 and four of CRP.

Research Protocol

Week	1^{st}	2^{nd}	3^{rd}	4^{th}
GROUP 1	Flutter	CRP	Flutter	CRP
GROUP 2	CRP	Flutter	CRP	Flutter

Each 60-minute session included 10 minutes of inhalation with bonchodilators (bromide of ipratropium and/or fenoterol), 20 minutes of the selected technique and 30 minutes of rest. All the secretion produced was collected in an appropriated recipient from the beginning of inhalation until the end of the resting period.

In each session, the expiratory peak flow was measured by the equipment ASSESS (Healthscan Products Inc) as well as the respiratory frequency were assessed before and after each application of the selected technique. The measurement of SpO_2, by means of pulse oxymeter (OHMEDA BIOX 3800) and the cardiac frequency were made before and after the application of the technique and at the end of the resting period.

Methods

The cardiac frequency was evaluated by direct counting during one minute and by the pulse oxymeter. The respiratory frequency was assessed by counting the respiratory movements in one minute.

Flutter® VRP1: during this technique the patient was in a seated position with the Flutter® VRP1 in horizontal position and connected to the mouth. The patient was instructed to inspire by the nose and produce a forced and rapid expiration in the equipment till onset of coughing, being encouraged to expectorate as much as possible. The use of the Flutter® VRP1 was then introduced till the next onset of coughing and the expectoration of secretion.

Conventional Respiratory Physiotherapy: the patient was positioned for postural drainage, with right and left lateral decubitus for 10 minutes in each side. In this opportunity the patients underwent clapping and vibrocompression. During the technique the patient was encouraged to cough and to eliminate secretion.

During both techniques the secretion was collected in an appropriated recipient, weighed in an analytical scale (SCIENTECH SA 120) and put in an oven (FANEM LTDA) at 50 ºC for 72 hours and than weighed again.

Both techniques were performed under supervision of a trained physical therapist according to the recommendations of Imle (1988) and Ciesla (1988).

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Statistics

The Anova test (followed by the test of Tukey) for repeated measures was used to evaluate alteration in the studied variables among the different days for the same technique.

The test "t" of Student was used to compare different techniques in the same moment. This same test was used for the comparison of the total amount of secretion eliminated with each technique. The level of significance was established in 5% (p< 0,05).

RESULTS

Thirteen patients took part in the study (8 female and 5 male); 3 patients did not conclude the study being one for worsening of the disease and two for private reasons. The results are from 10 patients that concluded the study. According to the test of pulmonary function, 3 patients showed mild pulmonary obstruction, 3 moderate and 2 severe obstruction. One patient showed normal pulmonary function and one was not tested. Data concerning the characteristic of the sample and to the pulmonary function of these 10 patients can be seen in TABLE 1.

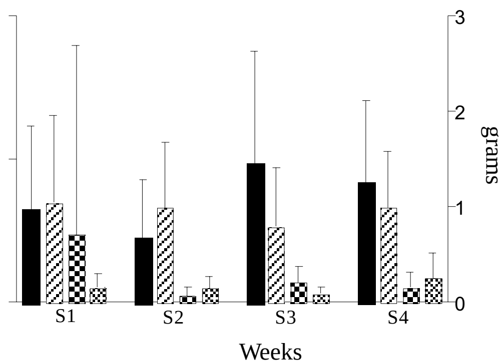
TABLE 1 – Characteristics of sex, age and values for pulmonary function test in patients with bronchiectasis

	Sex	Age	FVC pre BD	FEV_1 pre BD	FVC/FEV_1 pre BD	FVC post BD	FEV post BD	FVC/FEV_1 post BD
Group 1	3F 2M	66 ± 5	78% ± 20•	66% ± 32•	64% ± 16•	74% ± 15*	58% ± 27.62*	60% ±18.33•
Group 2	3F 2M	52 ± 17	70% ± 12	54% ± 17	62% ± 15	77% ± 10.72	58% ± 14	62% ± 17.05
Total		59 ± 14	73% ± 15♦	60% ± 24♦	63% ± 15♦	76% ±11.50♥	58% ± 18.16♥	

•N=4 *N=3 ♦N=9 ♥N=8

FVC = Forced vital capacity
FEV_1 = Forced expiratory volume in the 1st second
BD = Bronchodilatator

The average and total expectorated secretion with Flutter® VRP1 and with CRP did not show statistical significant difference (p>0,05). The average of expectorated secretion during all the session with Flutter® VRP_1 was 7.2 ± 2.30g of gross weight and 0.28 ± 0.28g of dry weight. For the CRP it was 6.3 ± 0.74g for gross weight and 0.16 ± 0.06g for dry weight. In PICTURE 1 it is possible to see the average values for secretion in the different methods of treatment for the two sessions performed each week. There were no significant differences (p>0,05) for values of respiratory frequency and for peak of expiratory flux before and after both techniques, as can be seen in TABLE 2 and 3. The values of final cardiac frequency showed a statistical significant diminution (p<0,05) in weeks 1 and 4 with the Flutter® VRP1 (TABLE 4). There was a significant diminution (p<0,05) of post-SpO_2 in comparison to the pre-value in the 3rd day of Flutter® VRP1. These data can be seen in TABLE 5.



PICTURE 1– Mean values for gross and dry weight of expectorated secretions, in grams, in the different weeks with Flutter® VRP1 and CRP

TABLE 2 - Data on the mean values of the respiratory frequency before and after each technique

Evaluation	Flutter® VRP1		CRP	
	RF pre	RF post	RF pre	RF post
D1	20 ± 3	22 ± 4	22 ± 5	20 ± 4
D2	22 ± 3	21 ± 4	21 ± 4	21 ± 3
D3	21 ± 4	20 ± 5	20 ± 3	23 ± 4
D4	20 ± 2	22 ± 5	22 ± 4	23 ± 4

p>0.05 for all variables

TABLE 3 - Mean values of the expiratory peak flow in liters/minute before and after the use of Flutter® VRP1 and CRP

Evaluation	Flutter® VRP1		CRP	
	PEF pre	PEF post	PEF pre	PEF post
D1	378 ±178	405 ± 157	409 ± 138	439 ± 175
D2	440 ± 208	434 ± 150	420 ± 167	417 ± 134
D3	418 ± 158	428 ± 166	407 ± 147	419 ± 157
D4	436 ± 165	456 ± 159	418 ± 183	462 ± 185

$p>0.05$ for all variables

TABLE 4 - Mean values for cardiac frequency before and after each technique and at the end of the therapy.

Evaluation	Flutter® VRP1			CRP		
	CF pre	CF post	final CF	CF pre	CF post	final CF
D1	77 ± 9	74 ± 7	72 ± 7*	77 ± 10	75 ± 13	73 ± 10
D2	77 ± 11	75 ± 9	75 ± 10	73 ± 8	71 ± 7	70 ± 8
D3	76 ± 15	78 ± 18	75 ± 14	76 ± 2	78 ± 15	76 ± 15
D4	79 ± 12	77 ± 12	75 ± 10*	82 ± 16	80 ± 15	80 ± 16

* $p<0.05$ for final FC when compared to the pre CF

TABLE 5 - Data on the mean values of SpO2, before and after each technique and at the end of the therapy

Evaluation	Flutter® VRP1			CRP		
	SpO_2 pre	SpO_2 post	SpO_2 final	SpO_2 pre	SpO_2 post	SpO_2 final
D1	95 ± 2	94 ± 3	94 ± 2	95 ± 3	94 ± 3	94 ± 2
D2	94 ± 2	94 ± 2	94 ± 2	95 ± 2	94 ± 2	95 ± 3
D3	95 ± 2	93 ± 3*	94 ± 2	95 ± 3	94 ± 2	94 ± 2
D4	94 ± 3	94 ± 4	94 ± 2	93 ± 3	94 ± 3	94 ± 2

*$p<0.05$ for post SpO_2 compared to pre SpO_2

DISCUSSION AND CONCLUSION

One of the main objectives of respiratory physiotherapy is to aid in the clearance of bronchial secretions in patients with hypersecretive pulmonary pathologies, such as bronchiectasis. Besides the conventional maneuvers (postural drainage, chest percussion and vibrocompression) new techniques that aid in the clearance of secretion have appeared in the last years such as the Flutter® VRP1.

The use of Flutter® VRP1 in patients with cystic fibrosis, bronchial asthma and chronic obstructive pulmonary disease (DPOC) resulted in an increase in the bronchial clearance, improvement of the pulmonary function and oxygenation (Girard & Terki, 1994; Konstan et al., 1994; Pryor et al., 1994). However, it was not possible to find in the literature any study that evaluates the efficacy of this technique in the clearance of secretions of patients with bronchiectasis.

Results of the present study shows that the amount of secretion expectorated with the use of Flutter® VRP1 is not different from that eliminated with CRP. In the literature, results with Flutter® in patients with cystic fibrosis are not conclusive. Studies by Lyons et al. (1992), in patients with cystic fibrosis, comparing four techniques: FRC, Flutter® VRP1 alone, Flutter® VRP1 associated to physiotherapy and Flutter® VRP1 without sphere associated with physiotherapy, revealed that the volume of secretion expectorated was smaller that with the isolated use of Flutter. They also concluded that the inclusion of Flutter® VRP1 has not brought any additional benefit to the conventional physiotherapy in patients with cystic fibrosis. Pryor et al. (1994) studied the effect of Flutter® VRP1 in 24 patients with cystic fibrosis. Patients were submitted to 2 consecutive days of treatment with 2 sessions daily. In the first day it was performed the active respiratory cycle that includes respiratory control, exercises of chest expansion and technique of forced expiration. In the second day, the Flutter® VRP1 was used for 10 minutes before the active respiratory cycle. Results have showed that the Flutter did not bring any benefit to these patients since the major part of the secretion was expectorated during the active respiratory cycle periods.

On the other hand, Konstan et al. (1994) have compared the amount of expectorated secretion after the use of Flutter® VRP1, voluntary cough and postural drainage with percussion and vibrocompression and concluded that Flutter® VRP1 is more efficient that the conventional techniques in the clearance of secretions in patients with cystic fibrosis. In the same way, App et al. (1998) have also reported a tendency to a greater volume of secretion expectorated with Flutter® VRP1 when compared to the autogenic drainage (the patient proceeded alone with his/her own therapy by mean of nasal inspiration, pause and one expiration in two phases: passive and active) in patients with cystic fibrosis).

The effects of Flutter® VRP1 in the pulmonary function have been demonstrated in recent studies. In a study in patients with productive asthma, Girard & Terki (1994) have observed a significant improvement in the expiratory peak flux, FEV_1 and current volume (CV) after the use of Flutter® VRP1. Cegla & Retzow (1993) have also observed improvement in the CV, FEV_1 and expiratory flux peak after 14 days of treatment with Flutter® VRP1 associated to drug therapy in patients with chronic obs-

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tructive pulmonary disease. The improvement in the peak of the expiratory flux was progressive during the entire period of the study and did not occur in the patients of the control group only received drug treatment alone. On the other hand, Pryor et al. (1994) did not observe improvement in the obstruction of the airway flux with Flutter® VRP$_1$ and have also not observed significant alteration in the oxygen saturation in patients with cystic fibrosis. In the present study it was not observed significant modifications in the expiratory flux peak before or after the use of Flutter® VRP$_1$ in comparison with the CRP either. Furthermore, only in the third day of use of the Flutter® VRP$_1$ there was a significant decrease in the SpO_2.

Some authors suggest that the conventional therapy can induce arrhythmia, mainly in patients with cardiac problems (Hammon et al., 1992), and diminution in the SaO_2. Possible side effects attributed to Flutter® VRP$_1$ are related to hyperventilation. Although this variable has not been monitored during the application of the technique, it was not observed increase in the CF and RF or arrhytmias were observed before or after the use of Flutter® VRP$_1$.

It is concluded from the studied sample that the use of Flutter® VRP$_1$ and the techniques of conventional physiotherapy (postural drainage, chest percussion and vibropression) are equally efficient in the clearance of secretions in patients with bronchiectasis. In addition, it was not observed significant and persistent modifications in the expiratory peak flow, cardiac frequency, respiratory frequency and SpO_2 with any of the techniques. The application of CRP requires a second person (physiotherapist or a trained family member) to an adequate result (Imle, 1988). In the present study, for a better control of the techniques, the Flutter® VRP$_1$ was used with supervision of a physiotherapist. However, after training and assessment of the patient's learning, the technique can be used with efficacy without supervision (Pryor et al., 1994). Taking into consideration that bronchiectasis is a chronic and irreversible pathology (Cohen & Sahn, 1999) and that the physiotherapic treatment should be permanent, the cost/benefit relation in the long run may favors the use of Flutter® VRP$_1$.

Studies with a greater number of patients and for longer periods evaluating the efficacy of the Flutter® VRP$_1$ in the evolution of patients with bronchiectasis and the cost/benefit relation compared to the CRP are necessary for a better theoretical and practical support regarding its use in the support therapy of such patients.

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